Successful LNG/CNG Implementation

Moving to Lower Carbon Fuels

THINK GREEN.

ACT EXPO 2014 – Long Beach, CA

Chuck White – Director
Regulatory Affairs/West
May 7, 2014

Waste Management is North America's leading provider of integrated waste management and environmental solutions

WM's 2013 Financial Stats	WM's 2013 Operational Stats			
$14.0B IN REVENUE	+21 MILLION CUSTOMERS	390 COLLECTION OPERATIONS	1 ACTIVE HAZARDOUS WASTE UNDERGROUND INJECTION FACILITY	18 SECONDARY PROCESSING FACILITIES
$1.3B FREE CASH FLOW	310 TRANSFER FACILITIES	4 INDEPENDENT POWER PRODUCTION PLANTS, 2 PRODUCE Biogenic Fuels	137 LANDFILL-GAS-TO-ENERGY PROJECTS	262 ACTIVE SOLID WASTE LANDFILLS
$922M RETURNED TO SHAREHOLDERS	120 TRADITIONAL RECYCLING FACILITIES	58 Natural Gas Fueling Stations 27 Also Serve The Public	36 ORGANIC PROCESSING FACILITIES	5 ACTIVE HAZARDOUS WASTE LANDFILLS
$1.3B CAPITAL EXPENDITURES	50 ARE SINGLE STREAM 12 ARE C&D RECYCLING FACILITIES		17 WASTE-TO-ENERGY PLANTS	OVER 42,700 EMPLOYEES

WM Sustainability Facts

- Creates enough energy to power more than 1.1M homes every year
- Manages over 15 million tons of recyclable commodities
- Dedicates 26,000 protected acres to wildlife habitats

WM's Strategy: Extract value from the materials we manage

WM will optimize our business and implement enhanced recycling and new conversion technologies.

WM will develop superior sorting, recycling, and conversion capabilities to capitalize on changes in the business environment.

THINK GREEN.

Alternative Transportation Fuel Technologies

Recovery of Energy Products via Emerging Processes

- LFG converted to ultra-low carbon low-carbon fuel for CNG/LNG trucks

- LFG to electricity sent to grid from which fleets power electric vehicles can qualify for cellulosic RINs and LCFS credit

- LFG to Diesel technology can produce advanced or cellulosic biofuels

Enerkem

- Commercial-scale facility 400-500 tpd
- Gasification of biogenic MSW and biomass to ethanol & synfuels

- MSW to ethanol via large-scale plasma gasification
- Commercial-scale facility 400-500 tpd

Fulcrum BIOENERGY

THINK GREEN.

WM Fleet Facts

- WM's Fleet Goal: Reduce emissions & increase fuel efficiency by 15% by 2020
  - GHGs already down 18%
- WM has 38,400 Vehicles
  - 20,400 Collection HDVs, 3000 in California
  - 18,000 MD & LD support & HD post collection transfer vehicles
- Over 3,200 NG HDVs -- 1500 in California ~50%
- 61 natural gas stations built in 27 states, 2 provinces
  - 10 public fueling stations + 12 others with 3rd party use
- 90% of new truck purchases are natural gas – Mostly CNG
- On line to purchase 700+ natural gas trucks per year

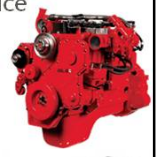
THINK GREEN.

Why Natural Gas?

- Natural Gas is cheaper than Diesel
- Changing diesel engine regulations – created uncertainty
  - Heavier = less payload = need more trucks = increased emissions
  - Uncertain maintenance costs associated with new diesel trucks
- Early bugs gone
  - Cummins Westport a good partner as NG technology has matured
- Customer/Driver Acceptance & Preference
- Emission Requirements easier/cheaper to meet with NG
- 25% Lower GHG Emissions
  - LCFS Incentives
- AB 118 Grants in California
  - Vehicles/Fueling Stations
- Waste Derived Biomethane
  - >90% Lower GHGs

CNG has become WM's platform of Choice

Cummins-Westport WM's Engine of Choice
- ISL-G for 250 to 300 hp
- ISX-G as GVW dictates 400 to 500 hp



Why CNG and Not LNG?
- Pipeline availability
- Slow fill overnight fueling w/ fast backup
- Less safety training involved
- Less Fugitive emissions
- Less maintenance cost
- Significantly cheaper cost of fuel per DGE

THINK GREEN:

Creating Energy from Waste

The energy in waste…

One Ton of Waste =

- 11 million BTUs of energy
- Holds the energy equivalent to:
  - ✓1 barrel of oil
  - ✓½ ton of coal
  - ✓11 MMBTUs of Natural Gas (aka: Dekatherm)
- Waste can make:
  - ✓5,500 lbs of steam
  - ✓400 to 600 KW Hrs of electricity
  - ✓50 gallons of ethanol

Source: GBB SW Consultants

©2012 Waste Management

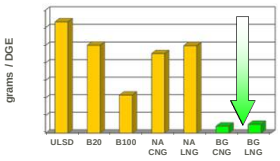
THINK GREEN:

Page 8

Where is Biogas Generated?

- Biogas is generated at:
  - ✓ Landfills
  - ✓ Anaerobic digestion of animal, food, sewage, & crop waste
  - ✓ Wastewater Treatment Plants
- Uses:
  - ✓ Can be upgraded to hi-purity bio-methane (& other fuels)
- Benefits
  - ✓ Low greenhouse gas emissions
  - ✓ Can displace 10 billion GGE per year (DOE estimate)
  - ✓ GHG emission reductions equal to taking 90 million light-duty vehicles off the road

WTW GHG Emissions



WM is partnering with LACSD to increase methane output at Wastewater Treatment Plants by adding processed food wastes

THINK GREEN:

Landfill Gas to Fuel

- A joint venture with Linde North America resulted in the world's largest plant to convert landfill gas to ultra low-carbon RNLG
- Carbon emissions are 90% lower than diesel.
- The facility produces up to 13,000 gallons of LNG a day
  - Over 10 million gallons produced to date
  - Fuels over 800 WM natural gas trucks in California – Using LCNG stations
- $15.5 million capital investment and $2 million in government grants

Waste Derived Transportation BioFuels

- BioGas Resources are readily available
  - Pipeline Distribution in California is now possible
- Waste Derived Fuels have Lowest GHGs
- Renewable LNG/CNG is cheaper than diesel
  - but more expensive than fossil NG
- RFS2 and Low Carbon Fuel Standards can provide supplemental revenue
  - Solid Waste industry could meet 40% of LCFS in 2020
- California 75% division goal
  - BioFuels are Recycling but CTs are not (SynFuels)
- BioFuels for Electricity values are falling

THINK GREEN:

Biomethane Vehicle Fuel: Barriers to Market

Efficient Vehicle Fueling with RNG:
- High BTU gas and pipeline distribution
- RNG production and fueling rarely co-located

Barriers to RNG Vehicle Fuel Use:
- Pipeline connection fees, tariffs & specifications discourage RNG pipeline injection (estimated costs: $1.8-$2.5 million)
- Market for vehicle fuel incentives (RFS2 & LCFS) are uncertain, illiquid and not "financeable"

THINK GREEN:

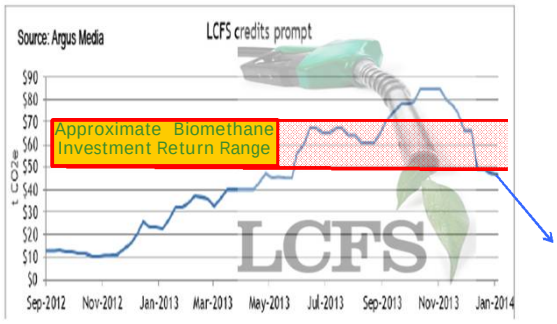
Biogas: "Well" to Wheels

- BioGas Resources plentiful
  - WM California BioGas Fleet
- California Waste Biomass
  - 2.1 Billion GGE
- Waste Derived Fuels: Lowest GHGs
- Renewable LNG/CNG is cheaper than diesel
  - But, more expensive than fossil NG
- RFS2 and Low Carbon Fuel Standards can provide supplemental revenue to "bridge the gap"

But, How to Finance with RFS2 and LCFS?

THINK GREEN:

California Low Carbon Fuel Standard



5/5/2014 14 THINK GREEN:

Bioenergy Association of California

48 Members across all waste and technology sectors, including industry, public agency and local government members

Focus on Policy Advocacy and Communications:

- Cap & Trade Revenues for bioenergy
- Transportation and Electricity Funding
- New standards for pipeline biomethane
- Utility purchase requirements (SB 1122)
- New legislation (organics recycling, etc.)

www.bioenergyca.org

California Green Credit Reserve

AB 2390 (Muratsuchi) – State to contract for the buying & selling of LCFS/RIN Credits

- BAC Sponsored
- For LC Fuels "in CA for CA"
- GCR Operated by Treasurer
- Enter into long-term contracts
- LCFS fuel developer secures financing & builds project
- When, and only when, fuel is produced and used in CA is GCR obligated to buy at negotiated price
- GCR turns around and sells credits to Obligated Parties

2/15/2012 Page 17 THINK GREEN:

Thank You -- *Any Questions?*

Chuck White
Director of Regulatory Affairs
Waste Management/West
cwhite1@wm.com
Phone 916-552-5859